

Endocarditis and Its Complications: The Role of Echocardiography

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Disclosures

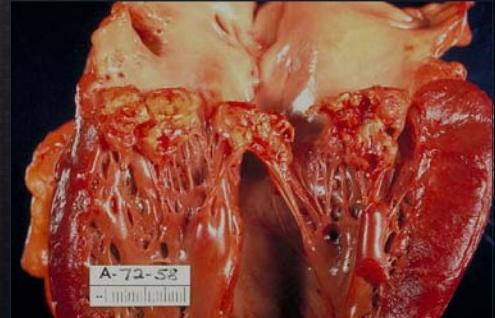
- ✓ No relevant financial disclosures



Endocarditis

- > 50,000 cases/yr in US (47,000 Medicare hospitalizations/year)
- Left sided - Majority of cases
- Highest mortality and complication rate

- ✓ Review
 - Guidelines for prophylaxis
 - Diagnosis and indications for TEE
 - Identification of complications
 - Prognostic (echocardiographic) features
 - Indications for surgery

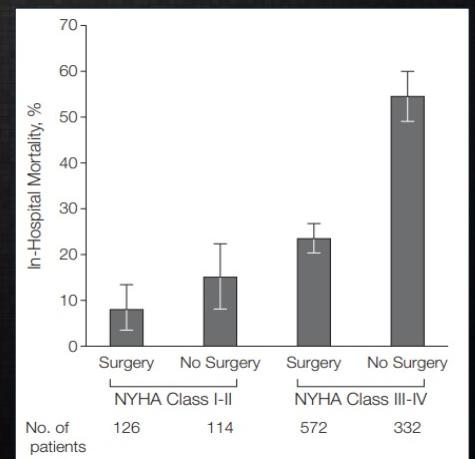


CDC/Dr. Edwin P. Ewing, Jr.



ICE-PCS

- ✓ 4100+ hospitalized cases of IE with CHF
- ✓ 30% 1 month mortality
- ✓ 33% of patients with advanced CHF (Class III or IV)
- ✓ In-hospital mortality of IE (without CHF) 13%



Keifer T et al. JAMA 2011

Prevention

- ✓ Antibiotic prophylaxis recommended:
 - Prosthetic heart valves or prosthetic material valve repair
 - History of endocarditis
 - Heart transplant with abnormal valve function
 - Certain congenital heart defects
 - Cyanotic heart disease, not fully repaired
 - Within 6 months of repair of defect
 - Repairs with residual defects and/or leaks

American Heart Association 2007



Infective Endocarditis Prophylaxis

NOT recommended for:

- Transesophageal echocardiography
- EGD
- Colonoscopy
- Cystoscopy without ongoing infection

Regardless of valvular/endocarditis risk



2017 AHA/ACC Focused Update

- Antibiotic prophylaxis before dental procedures now is also recommended for:
 - Patients with transcatheter prosthetic valves, and for
 - Patients with prosthetic material used in valve repair
 - Annuloplasty rings and/or artificial chords
 - Class IIa, Level of Evidence [LOE] C-LD

Nishimura RA et al. 2017 AHA/ACC Focused Update of 2014 Guidelines



PREVENTION OF INFECTIVE (BACTERIAL) ENDOCARDITIS Wallet Card														
<p>This wallet card is to be given to patients (or parents) by their physician. Healthcare professionals: Please see back of card for reference to the complete statement.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">Name:</td> <td colspan="2" style="width: 90%;">needs protection from INFECTIVE (BACTERIAL) ENDOCARDITIS because of an existing heart condition.</td> </tr> <tr> <td>Diagnosis:</td> <td colspan="2"></td> </tr> <tr> <td>Prescribed by:</td> <td colspan="2"></td> </tr> <tr> <td>Date:</td> <td colspan="2"></td> </tr> </table> <p>You received this wallet card because you are at increased risk for developing adverse outcomes from infective endocarditis (IE), also known as bacterial endocarditis (BE). The recommendations for prevention of IE are based on the following sources:</p> <ul style="list-style-type: none"> Members of the American College of Cardiology-American Heart Association Task Force on Clinical Practice Guidelines and the American Heart Association's Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee. Prevention of infective endocarditis: guidelines for healthcare professionals. Circulation. 2007;115:849-873. This document contains an extensive review of the literature on IE, extensively reviewed studies in order to determine whether dental, gastrointestinal (GI), or genitourinary (GU) tract procedures are possible causative agents for IE. It also provides information on potential prophylactic regimens for certain patients at increased risk of developing IE and at highest risk of poor outcomes from IE. The practice of routinely giving antibiotics to patients at risk for endocarditis is not recommended for all patients with heart disease EXCEPT for patients with the highest risk of adverse outcomes resulting from IE, such as those with prosthetic heart valves. If you develop symptoms of endocarditis, such as unexplained fever, contact your doctor right away. If blood cultures are necessary to determine if endocarditis is present, please ask your doctor to obtain these cultures and other relevant tests BEFORE antibiotics are started. <p>Antibiotic prophylaxis with dental procedures is reasonable for patients with cardiac conditions associated with the highest risk of adverse outcomes from endocarditis, including:</p> <ul style="list-style-type: none"> • Prosthetic cardiac valves, including transcatheter-implanted prostheses and homografts • Prosthetic material used for cardiac valve repair, such as annuloplasty rings and chords • Previous endocarditis • Congenital heart disease (CHD) only in the following categories: <ul style="list-style-type: none"> -Unrepaired cyanotic CHD, including those with palliative surgery or shunts -Completely repaired congenital heart defect with prosthetic material or devices, whether placed by surgery or catheter intervention, that have been in place for less than 6 months -Repaired CHD with residual shunts or valvular regurgitation at the site or adjacent to the site of a prosthetic patch or prosthetic valve -Cardiac transplantation recipients with valve regurgitation due to a structurally abnormal valve <p>*Except for the conditions listed above, antibiotic prophylaxis before dental procedures is not recommended for other forms of CHD.</p> <p>†Prophylaxis is reasonable because endothelialization of prosthetic material occurs within six months after the procedure.</p>			Name:	needs protection from INFECTIVE (BACTERIAL) ENDOCARDITIS because of an existing heart condition.		Diagnosis:			Prescribed by:			Date:		
Name:	needs protection from INFECTIVE (BACTERIAL) ENDOCARDITIS because of an existing heart condition.													
Diagnosis:														
Prescribed by:														
Date:														
<p>Dental procedures for which prophylaxis is reasonable in patients with cardiac conditions listed on reverse side.</p> <p>Prophylaxis against IE is reasonable before dental procedures that involve manipulation of gingival tissue or the periapical region of teeth, or perforation of the oral mucosa.*</p> <p>*Antibiotic prophylaxis is NOT recommended for the following dental procedures: scaling and root planing, tooth extraction, placement of orthodontic braces, and shedding of deciduous teeth and breeding of teeth to the tip of one another.</p>														
Antibiotic Prophylactic Regimens for Dental Procedures														
Situation	Agent	Regimen—Single Dose before procedure Against IE												
Oral	Aztreonam	2 g 50 mg/kg												
Unable to take oral medication	Ampicillin OR Cefazolin or ceftriaxone	2 g IM or IV* 50 mg/kg IM or IV												
Allergic to penicillins or ampicillin – Oral regimen	Cephalexin** OR Clindamycin	1 g IM or IV 50 mg/kg 600 mg 20 mg/kg												
Allergic to penicillins or ampicillin – Unable to take oral medication	Asthamopen or clarithromycin	500 mg 15 mg/kg												
Allergic to penicillins or ampicillin – Unable to take oral medication	Cefazolin or ceftriaxone OR Clindamycin	1 g IM or IV 50 mg/kg IM or IV 600 mg IM or IV 20 mg/kg IM or IV												
<p>*IM = intramuscular; IV = intravenous **Second-generation oral cephalosporin in equivalent adult dose or pediatric dosage. †Cephalosporins should not be used in an individual with a history of anaphylaxis to penicillins or cephalosporins.</p>														
<p>Gastrointestinal/Gastroscopy Procedures: There is no evidence for IE prophylaxis in GI or GU procedures absent known or nosocomial infection.</p> <p>Other Procedures: procedures involving the respiratory tract or infected skin, tissues just under the skin, or musculoskeletal tissue for which prophylaxis is reasonable are discussed in the document referenced below.</p>														
<p>Adapted from Prevention of Infective Endocarditis: Guidelines From the American Heart Association/American College of Cardiology and the Centers for Disease Control and Prevention. Prevention of Endocarditis, and Kawasaki Disease. Circulation. 2007;115:1736-1754. Accessible at www.ahajournals.org.</p>														
<p>Healthcare Professionals – Please refer to these recommendations for more complete information as to which patients and which dental procedures it would be reasonable for antibiotic prophylaxis to reduce risk of infective endocarditis.</p>														
<p>ADA American Dental Association® The Council on Scientific Affairs of the American Dental Association has approved this statement as it relates to dentistry.</p>														
<p>American Heart Association® American Stroke Association® Stroke is preventable. National Center 7272 Greenville Avenue Dallas, Texas 75231-4398 www.heart.org</p>														

Diagnosis

- ✓ At least 2 sets of blood cultures
- ✓ Modified Duke Criteria for suspected IE
- ✓ Transthoracic recommended in those with suspected IE
 - Assess for vegetations
 - Assess hemodynamic severity of valve lesions
 - Assess cardiac function
 - Re-evaluation for clinical change/symptoms

Nishimura et al. Valvular Heart Disease Guidelines, JACC 2014



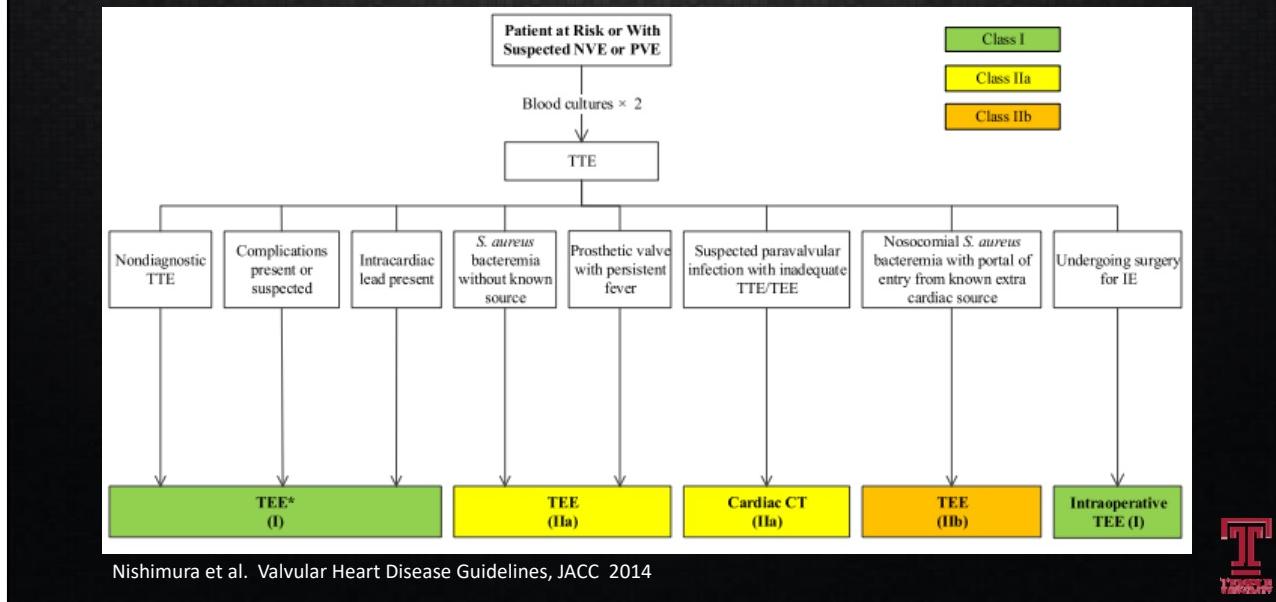
Modified Duke Criteria

- ✓ Definite infective endocarditis
 - Clinical Criteria
 - 2 Major criteria, or
 - 1 Major criterion and 3 minor criteria, or
 - 5 Minor criteria
 - Major criteria
 - Blood culture positive
 - Typical microorganism for IE (multiple variations)
 - Endocarditis by imaging study

Circulation 2005;111:e394-434



Imaging Recommendations



Echocardiography Criteria

- ✓ Evidence of endocarditis
 - **Oscillating intracardiac mass on valve or supporting structures, in the path of regurgitant jets**, or on implanted material in the absence of an alternative anatomic explanation, or
 - **Abscess**, or
 - New **partial dehiscence** of prosthetic valve, or
 - New valvular regurgitation

Circulation 2005;111:e394-434



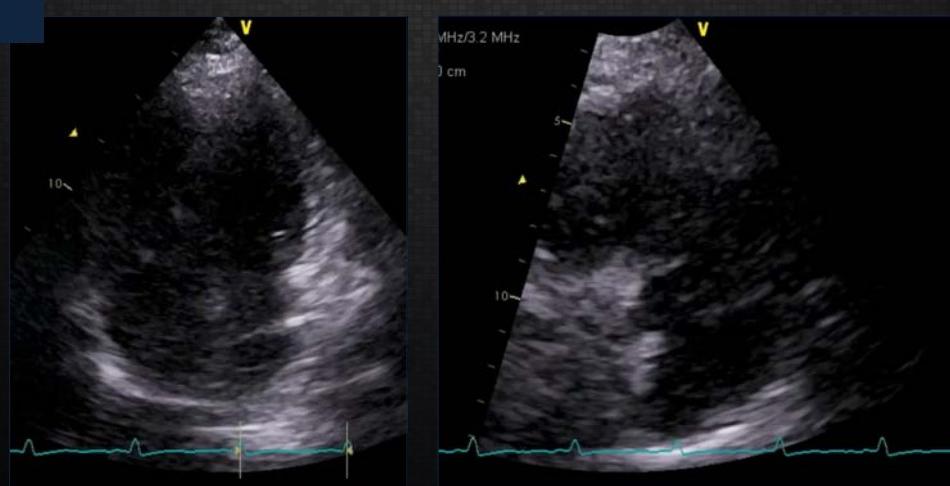
Rule Out Endocarditis!

- Negative or non-diagnostic TTE
 - TEE if clinical suspicion high
 - If TEE negative and clinical suspicion persists
 - REPEAT studies at 5-12 days
 - Vegetations or abscess may now be present
 - If still negative, look for another source
 - Pacemaker, vascular grafts, catheters, PDA
 - CIED (Cardiac Implantable Electronic Device) Infections



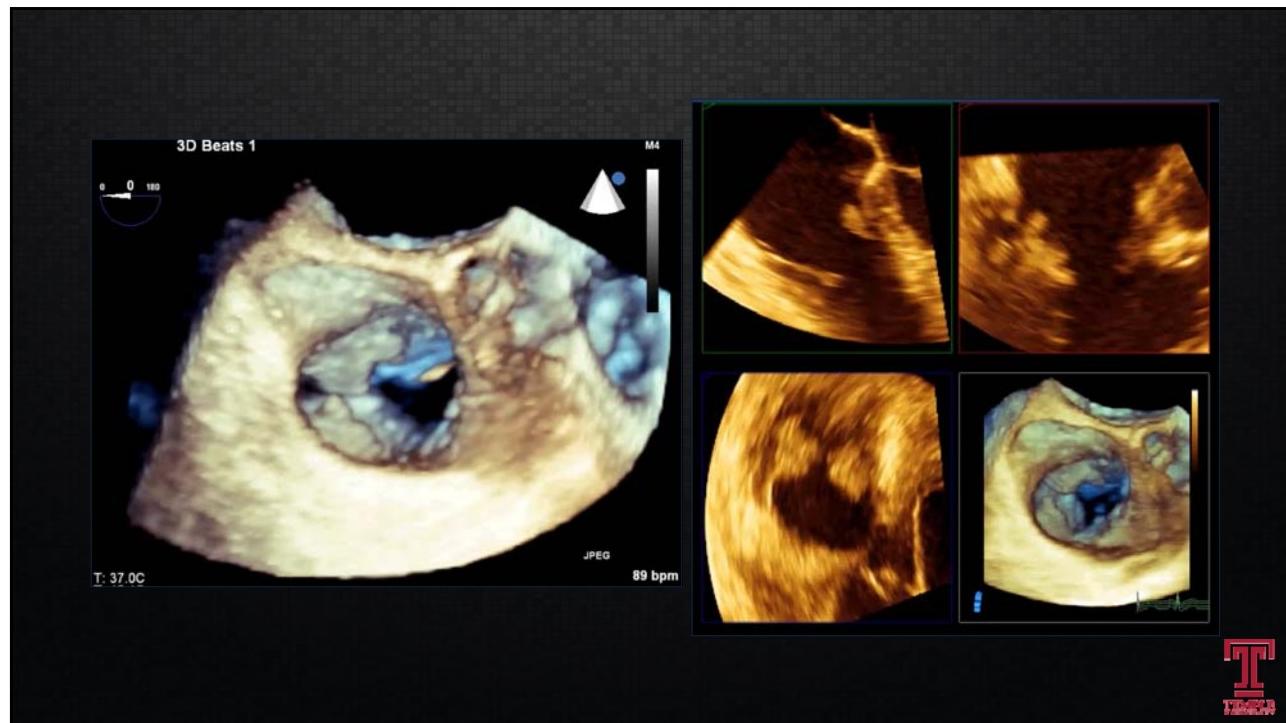
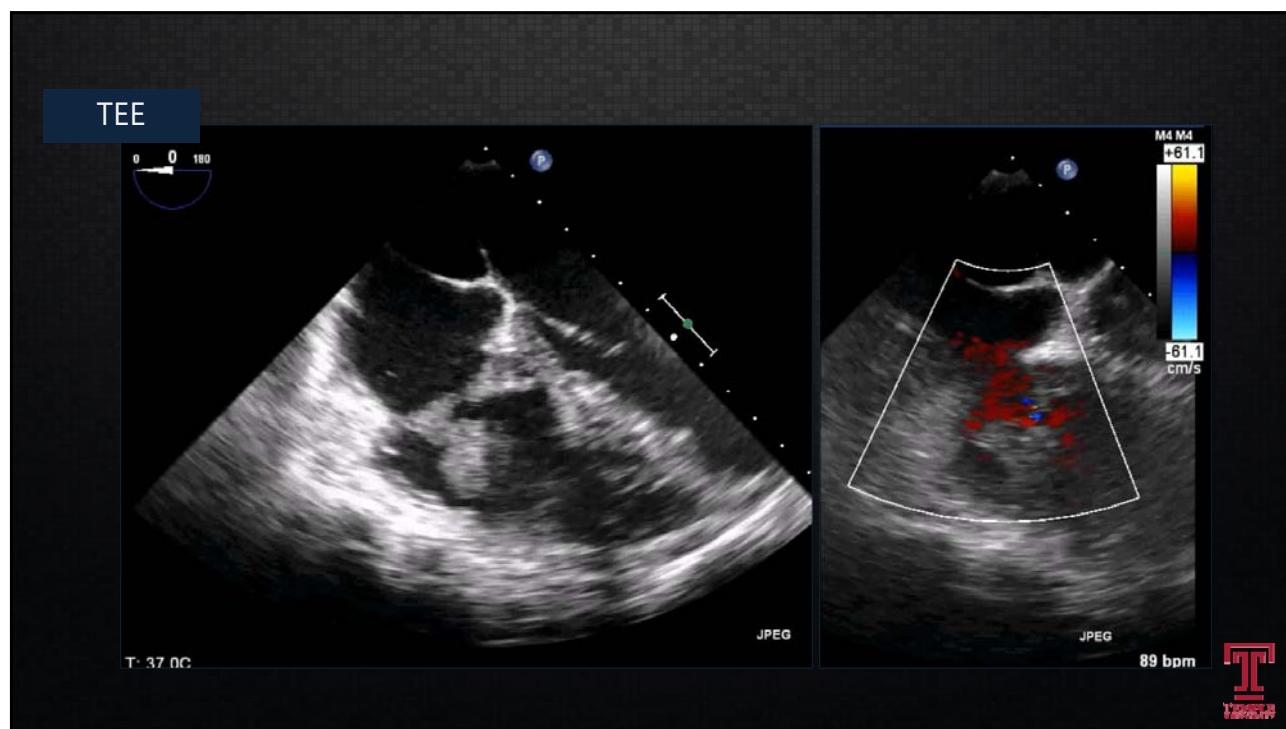
Rule out Endocarditis!

TTE



47 yo Female, IV drug abuse, +Blood cultures (MRSA), persistent fevers.





Echocardiography

Transthoracic

- ✓ Resolution ~ 3-4 mm
- ✓ Sensitivity: 62-82%
- ✓ Specificity: 91-100%
- ✓ Readily available, usual initial test of choice

Transesophageal

- ✓ Resolution ~ 1-2 mm
- ✓ Sensitivity: 87-100%
- ✓ Specificity: 91-100%
- ✓ Greater (3-4x) sensitivity for prosthetic valves

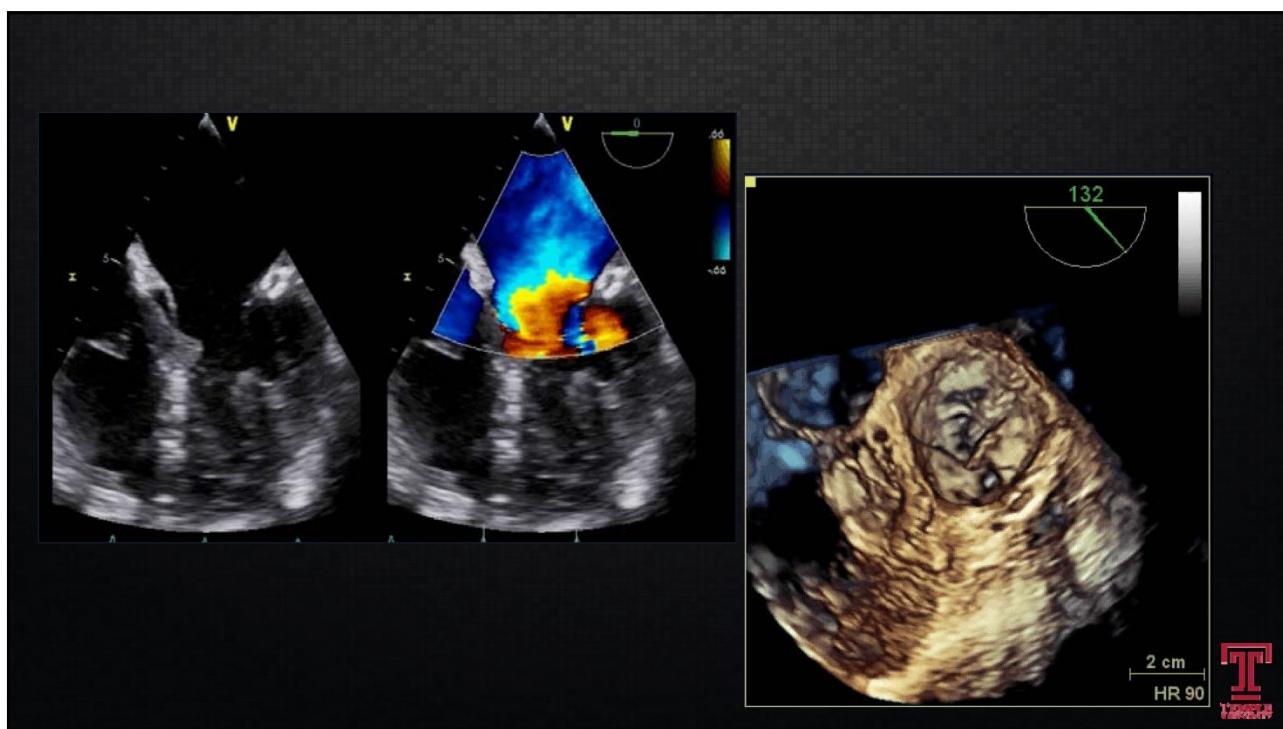
Jacob S et al. Curr Opin Cardiol 2002;
Kini V et al. JASE 2010; Pederson WR et al. Chest 1991



Case

58 yo Female, chronic IV drug abuse presents with fever and malaise. +Blood cultures (MSSA). Acute HF





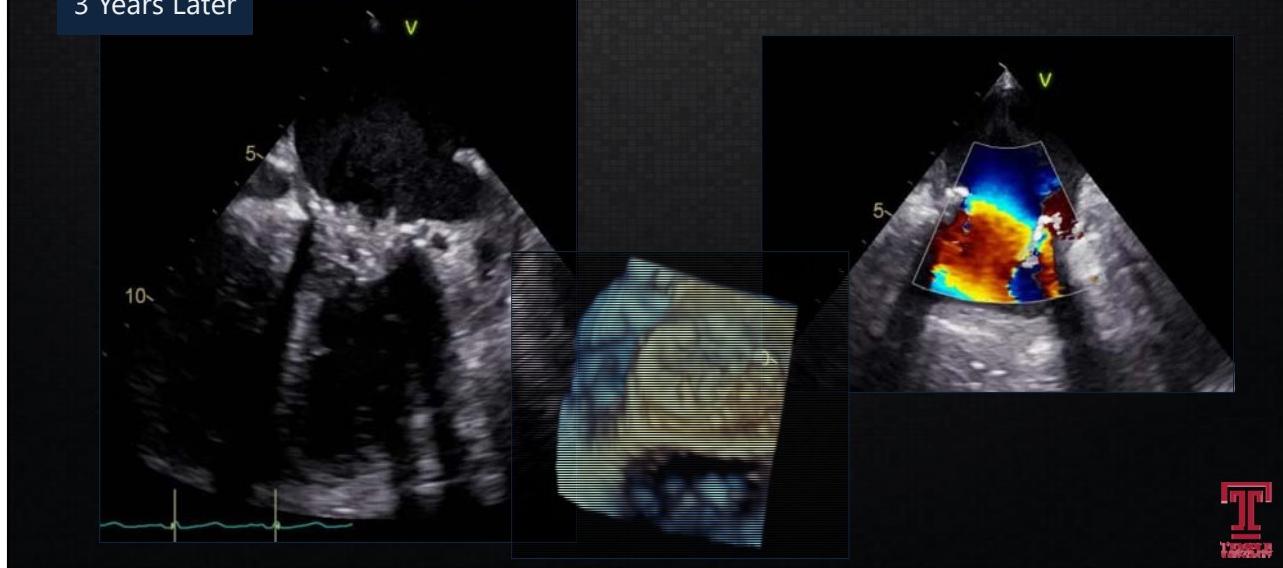
Post-Op

- Surgery:
 - Totally endoscopic robotic repair
 - P3 Resection
 - Pericardial patch repair
 - Mitral annuloplasty ring
 - No significant MR



Old Habits Die Hard

3 Years Later



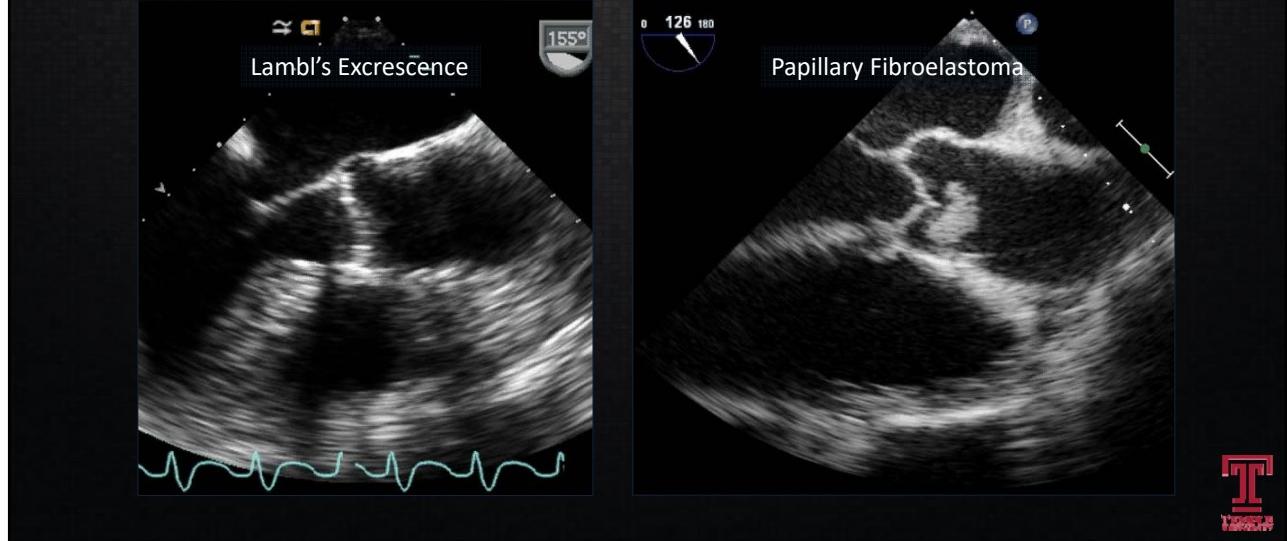
Leaflet Aspect

- ✓ Infective endocarditis
 - More commonly seen on the **upstream aspect**
 - Ventricular surface of AV with AI
 - Atrial surface of MV with MR
 - Usually at a site of endothelial damage

- ✓ **Downstream Aspect**
 - Usually a degenerative finding
 - Papillary fibroelastoma
 - Chordal structure (MV)
 - Less likely associated with significant regurgitation

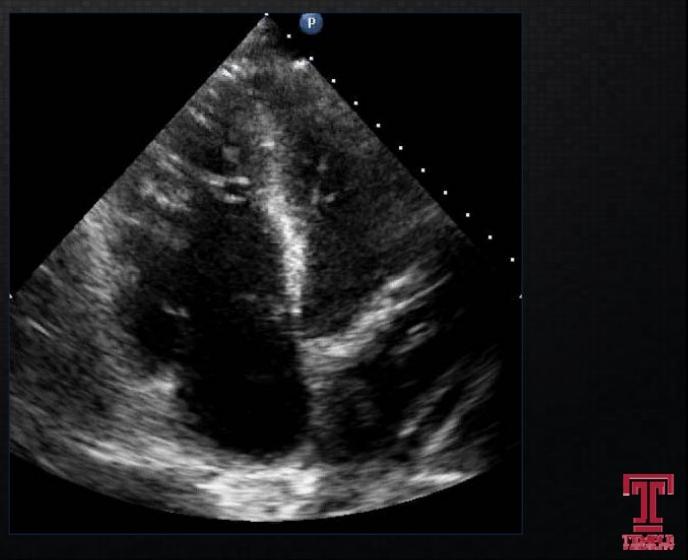


Downstream Aspect

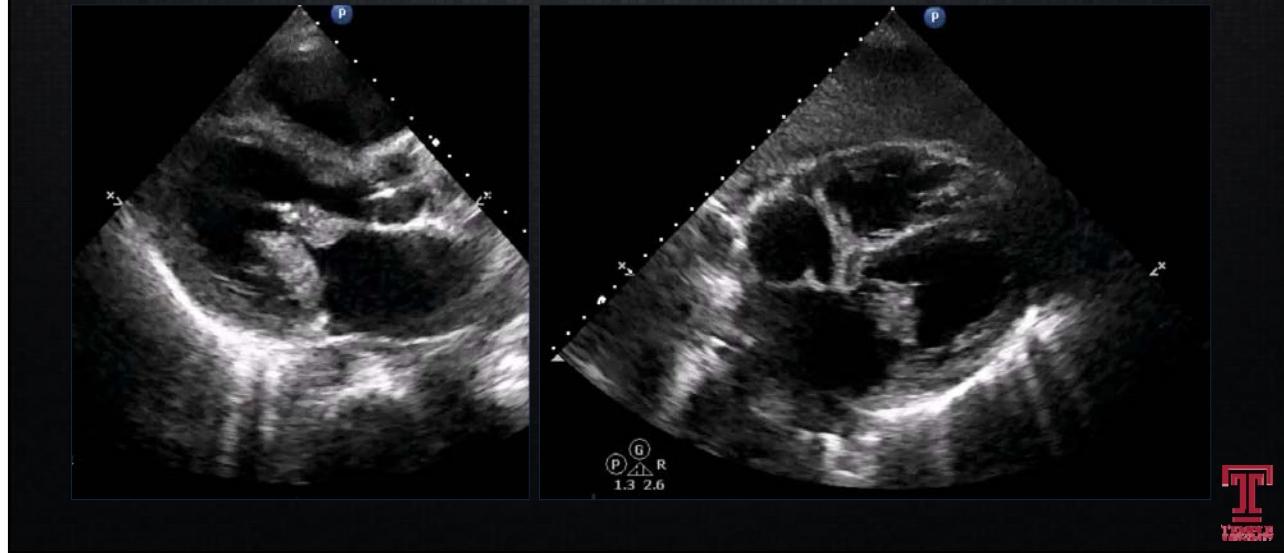


Downstream Aspect

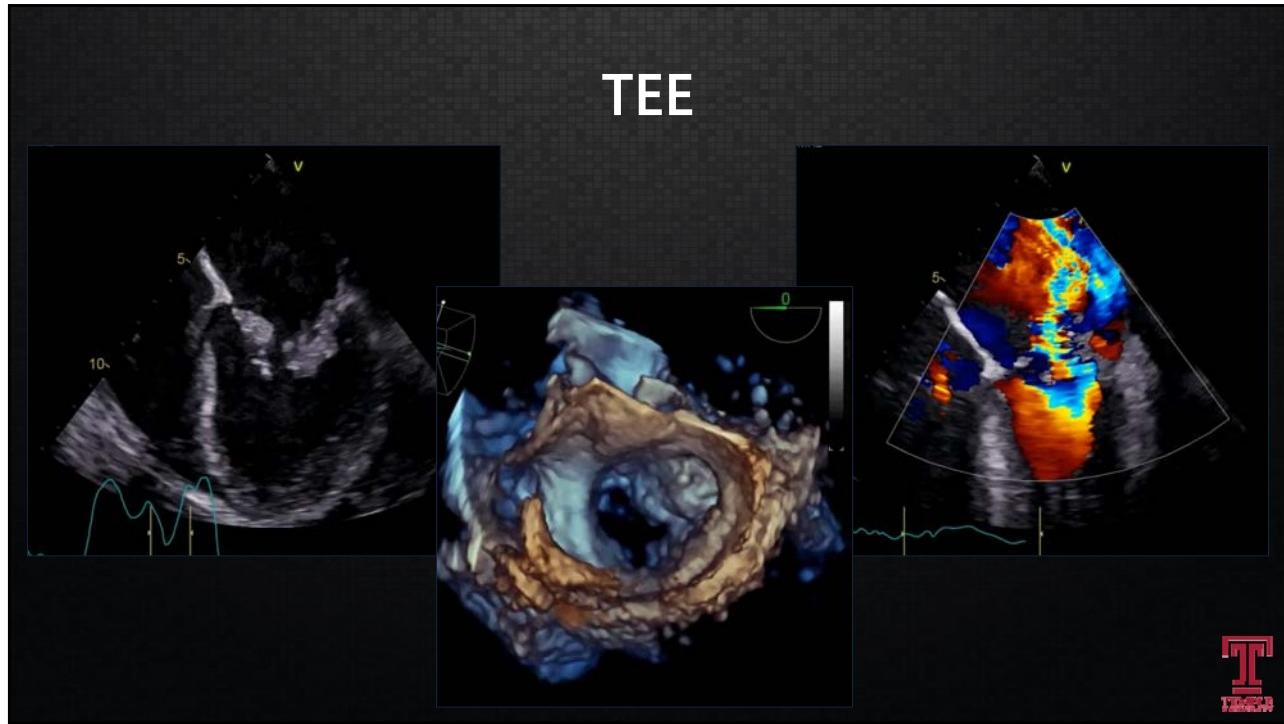
47yo Male presenting
with acute DVT and PE



Upstream or Downstream?

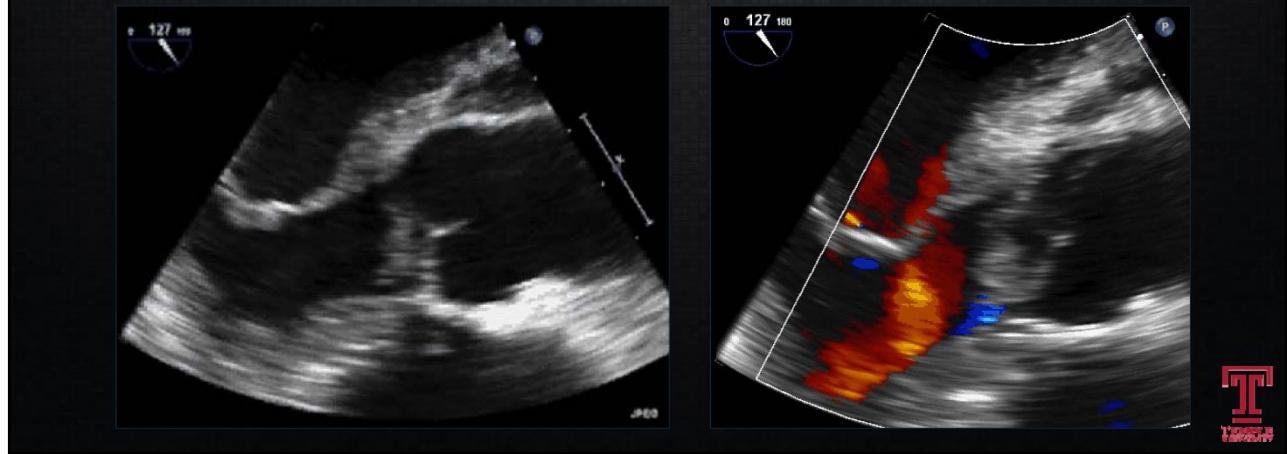


TEE



Case

49 yo Male with a progressive mandibular infection
and +Blood cultures (Strep pneumo)

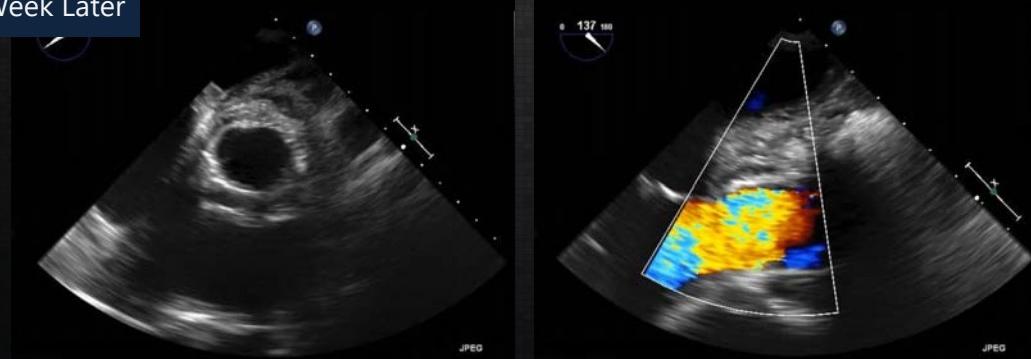


Natural History



Surgery

1 Week Later



Underwent a Ross procedure (pulmonary autograft) with aortic root reconstruction



Complications of IE

- ✓ Leaflet perforation
- ✓ **Aortic root abscess**
- ✓ Annular perforation
- ✓ **Fistula formation**
- ✓ Embolism
- ✓ **Purulent pericarditis**
- ✓ Hardware infection
- ✓ Erosion



Glossary

	Surgery/necropsy	Echocardiography		Surgery/necropsy	Echocardiography
Fistula	Communication between two neighbouring cavities through a perforation.	Colour-Doppler communication between two neighbouring cavities through a perforation.		Vegetation	Infected mass attached to an endocardial structure or on implanted intracardiac material.
Valve aneurysm	Saccular outpouching of valvular tissue.	Saccular bulging of valvular tissue.		Abscess	Perivalvular cavity with necrosis and purulent material not communicating with the cardiovascular lumen.
Dehiscence of a prosthetic valve	Dehiscence of the prosthesis.	Paravalvular regurgitation identified by TTE/TOE, with or without rocking motion of the prosthesis.		Pseudoaneurysm	Perivalvular cavity communicating with the cardiovascular lumen.
				Perforation	Interruption of endocardial tissue continuity.

2015 ESC Guidelines for Infective Endocarditis

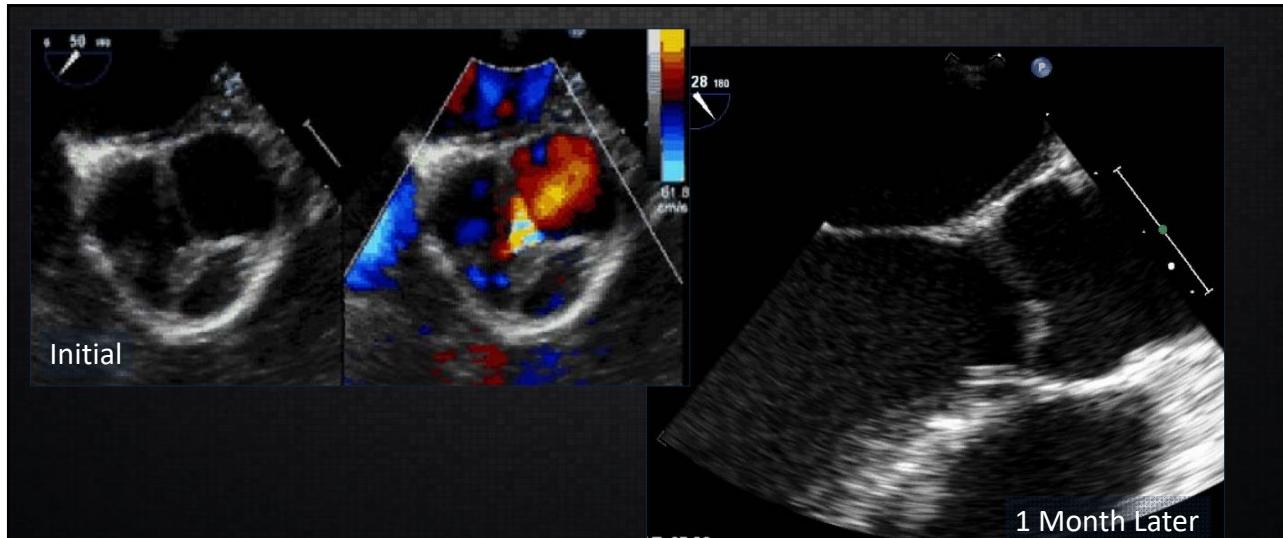
Indications for Early Surgery

- ✓ Valve dysfunction/ADHF
- ✓ Resistant organisms: Staph Aureus, Fungus
- ✓ Heart block or abscess formation
- ✓ Large mobile vegetation
- ✓ Persistent positive blood cultures
- ✓ Prosthetic valve endocarditis
- ✓ Fungal endocarditis
- ✓ Recurrent embolization



Case

18 yo Female present with an acute L MCA stroke and lower extremity thromboembolism. Negative blood cultures. New dx SLE



Treated with SC Lovenox. Returned for followup TEE.
Moderate aortic insufficiency (improved).

Dx: Libman-Sacks Endocarditis



Differential Diagnosis

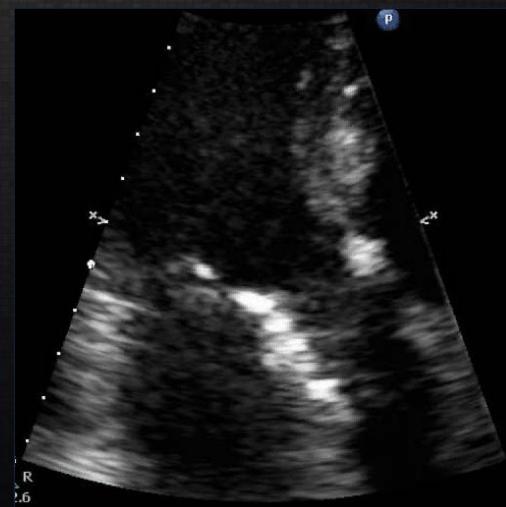
- ✓ Vegetation
 - Infective vs. non-infective/marantic
- ✓ Lambl's excrescence
- ✓ Papillary fibroelastoma (PFE)
- ✓ Thrombus
- ✓ Ruptured chord
- ✓ Valvular strands
- ✓ Myxomatous



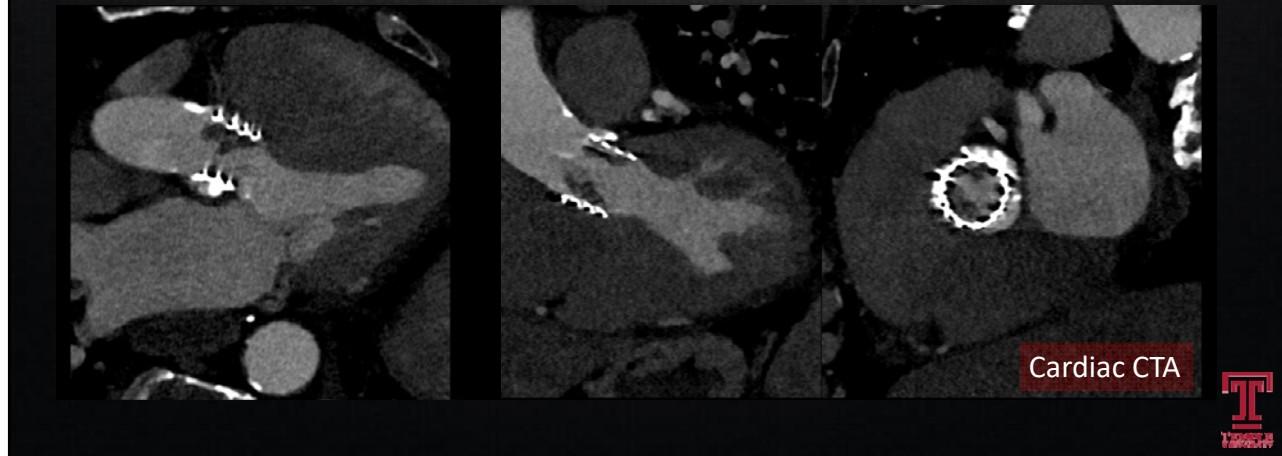
Case

74 yo Male with prior TAVR Sapien THV aortic valve presents with a cold left arm

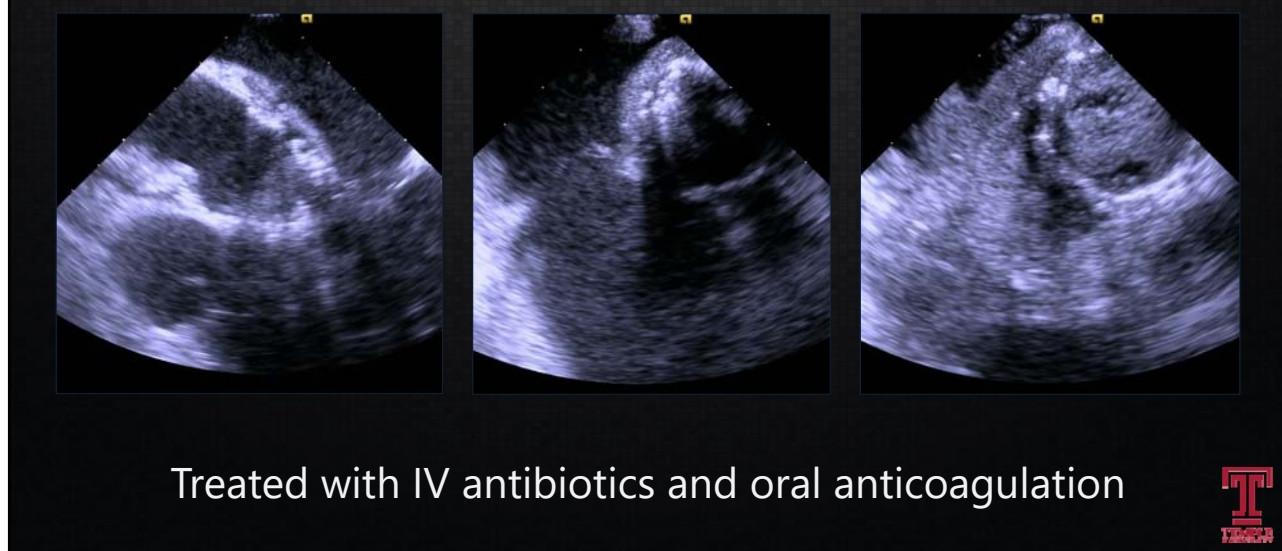
Urgent embolectomy. +Blood cultures (Strep)



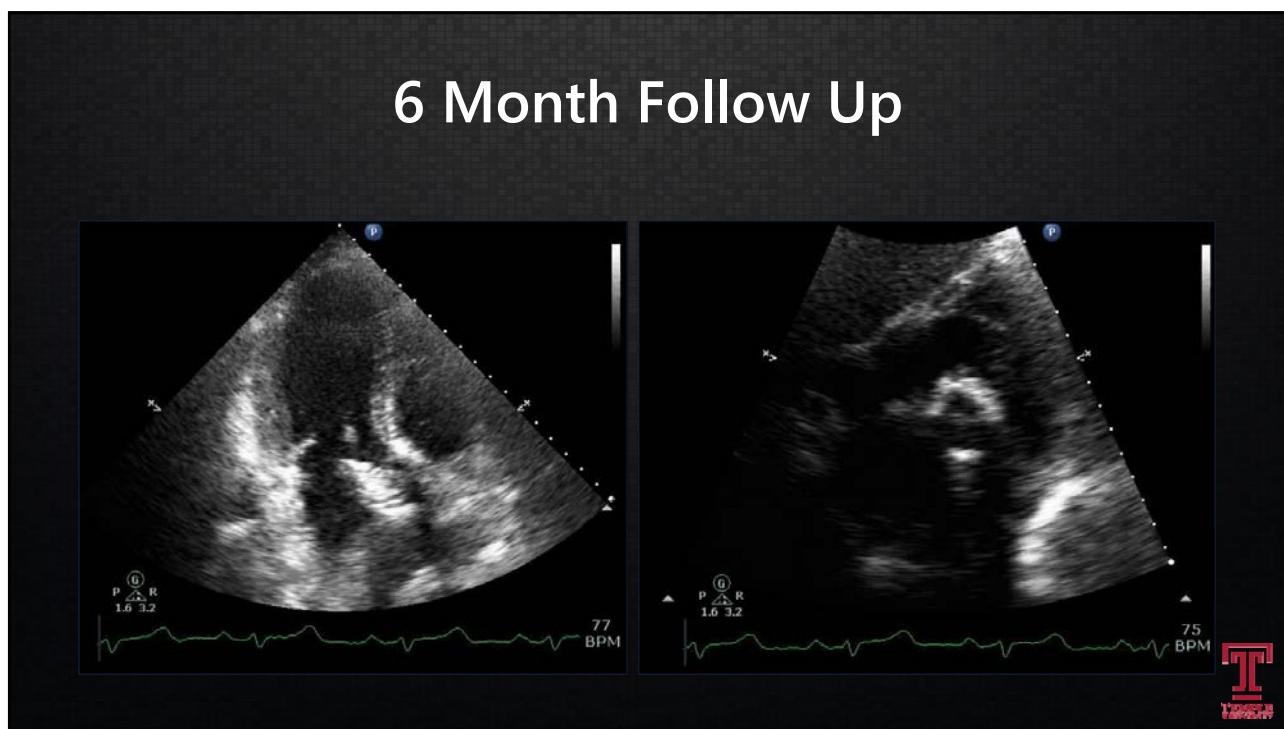
Unable to perform TEE due to **scleroderma esophagitis**.
Cardiac CT and Intracardiac echocardiogram performed
to better characterize valve.



Intracardiac Echocardiography



6 Month Follow Up



Endocarditis vs. Thrombosis

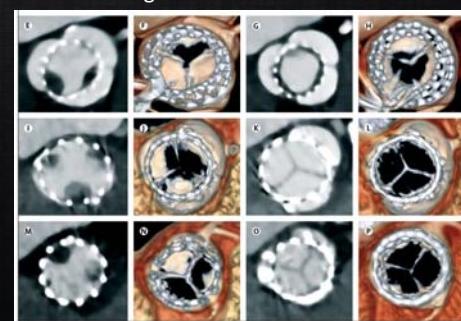
Subclinical leaflet thrombosis in surgical and transcatheter bioprosthetic aortic valves: an observational study

Tarun Chakravarty, Lars Søndergaard, John Friedman, Ole De Backer, Daniel Berman, Klaus F Kofoed, Hasan Jilaihawi, Takahiro Shiota, Yigal Abramowitz, Troels H Jørgensen, Tanya Rami, Sharjeel Israr, Gregory Fontana, Martina de Knecht, Andreas Fuchs, Patrick Lyden, Alfredo Trento, Deepak L Bhatt, Martin B Leon, Raj R Makkar, on behalf of the RESOLVE and SAVORY Investigators*

DAPT



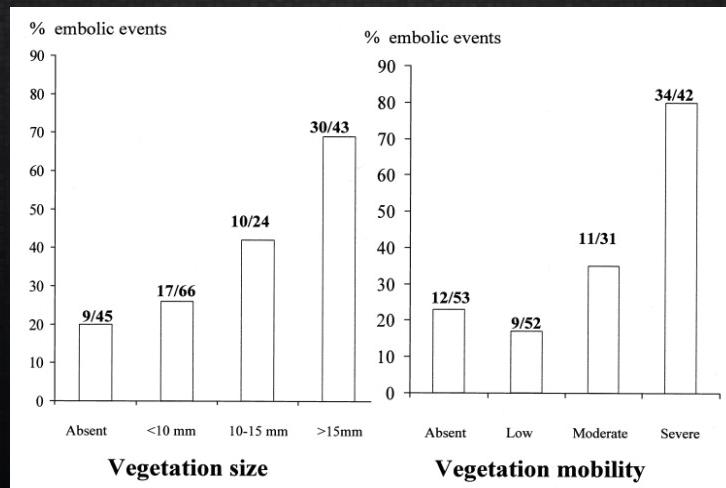
Oral Anticoagulation



Chakravarty et al. Lancet 2017



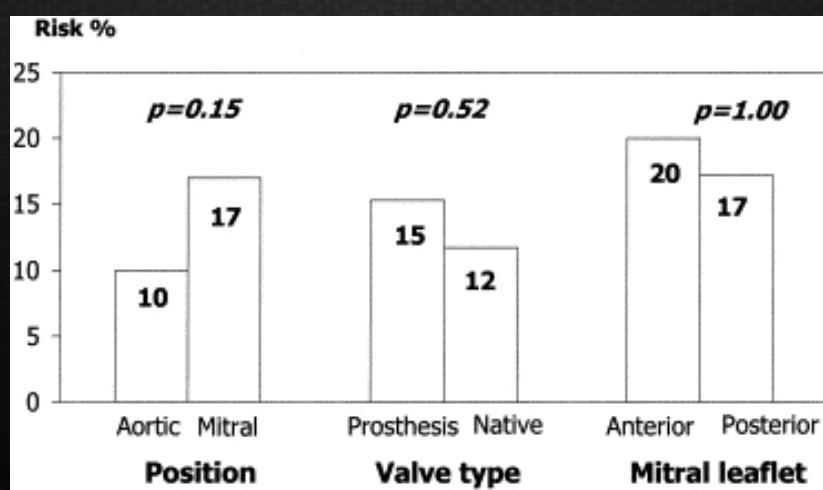
Size, Mobility and Embolic Events



DiSalvo et al. JACC 2001



Location, Location, Location

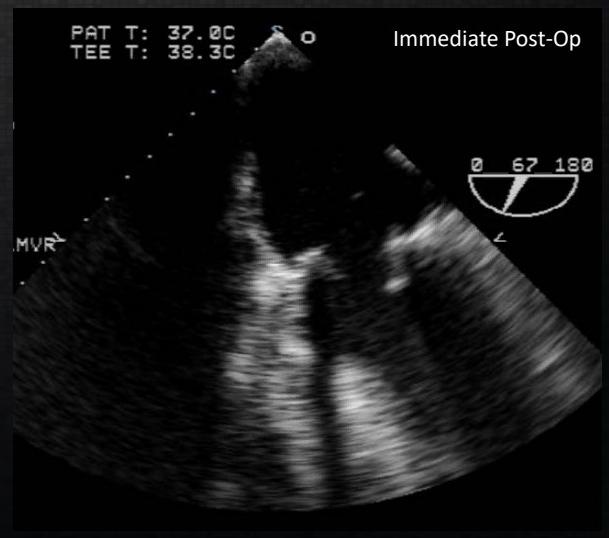


Villacosta et al. JACC 2002

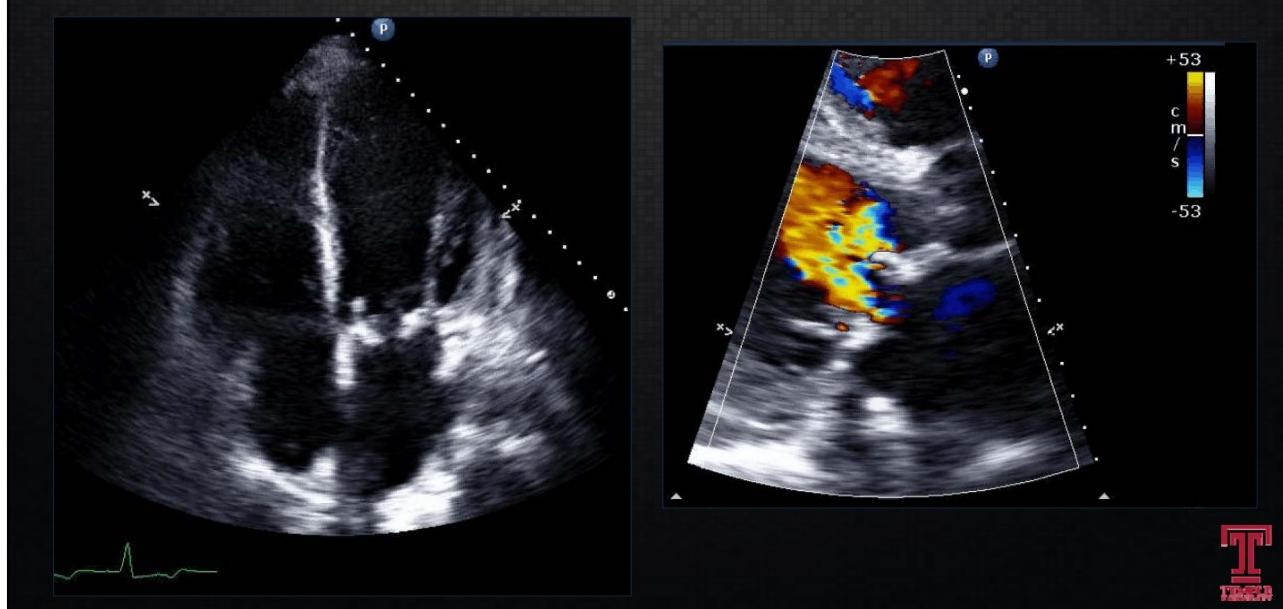


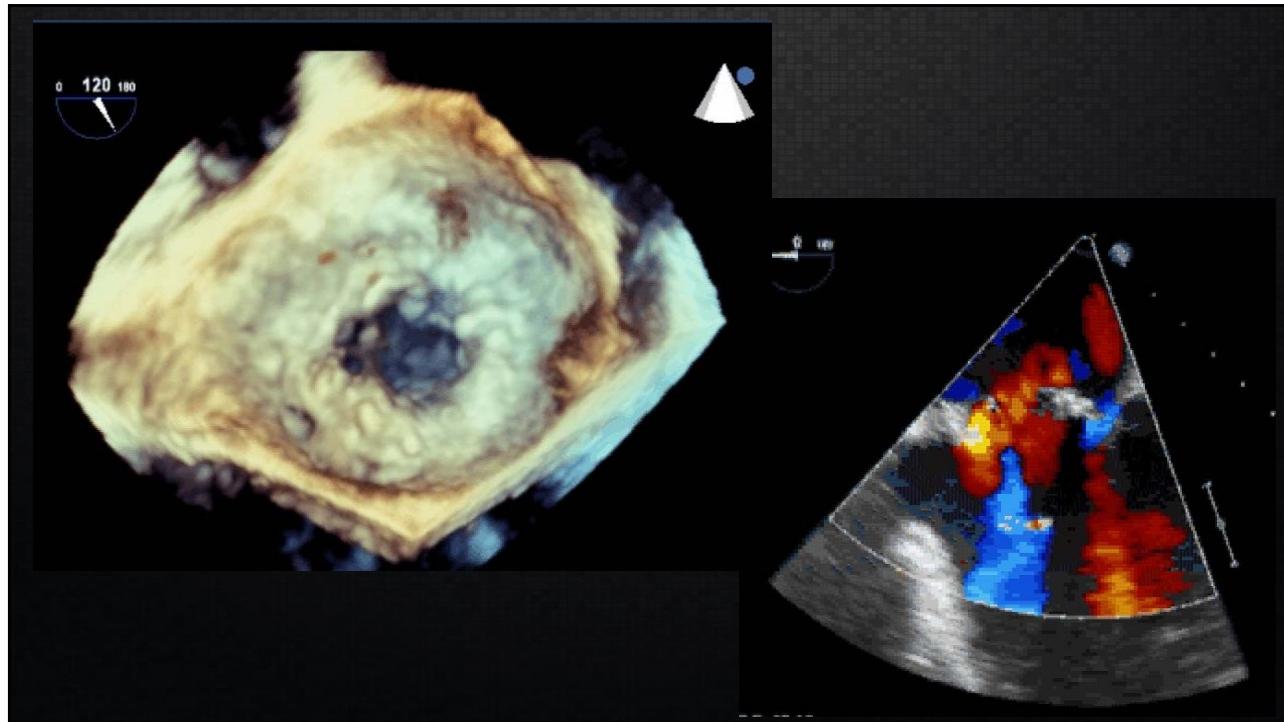
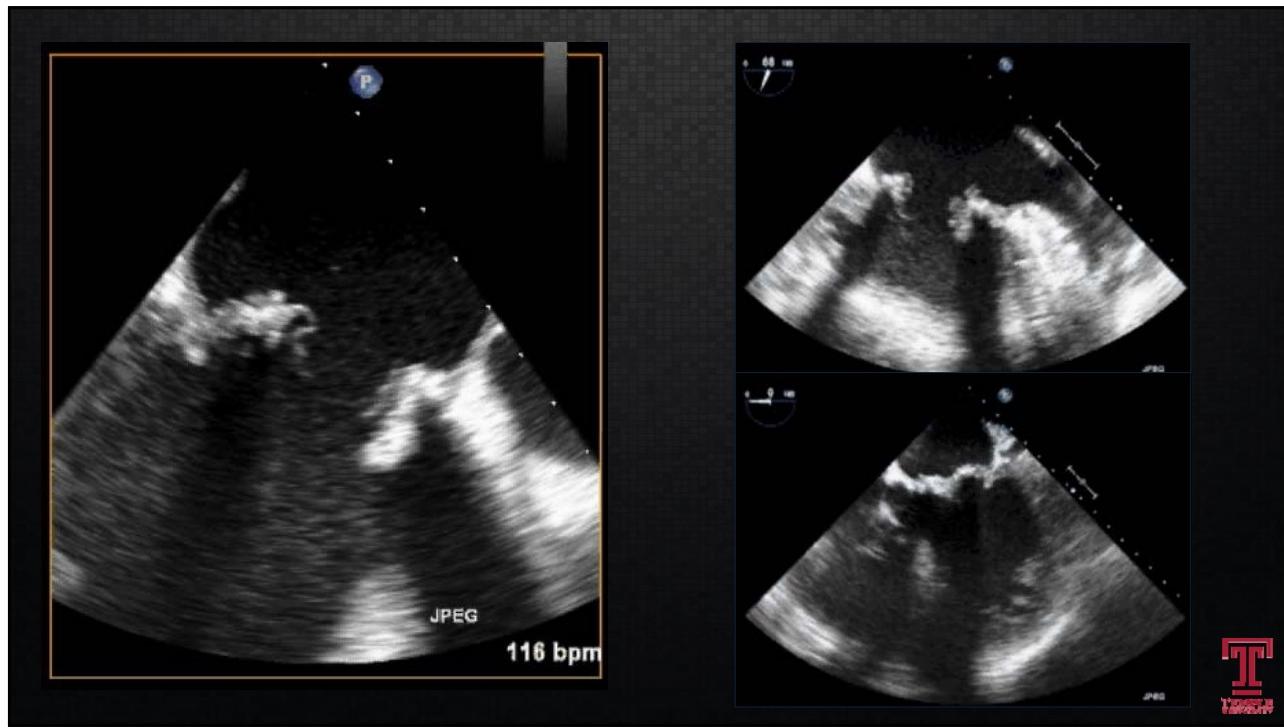
Case

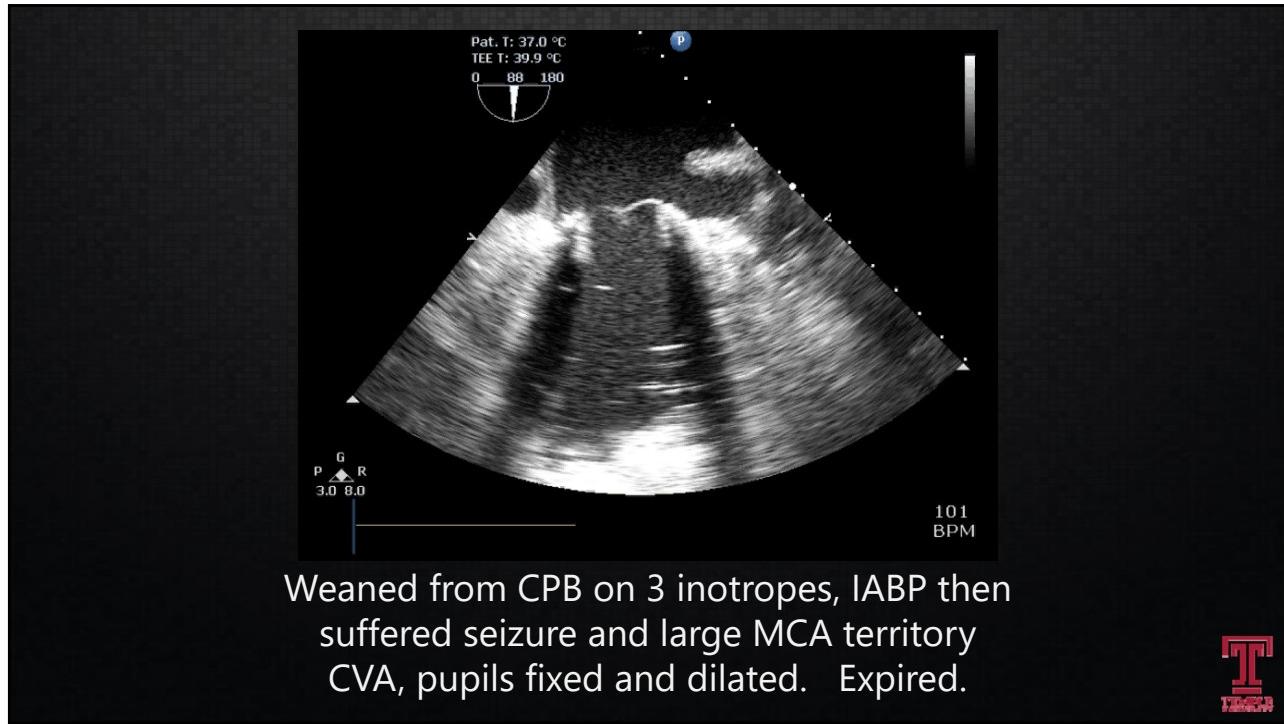
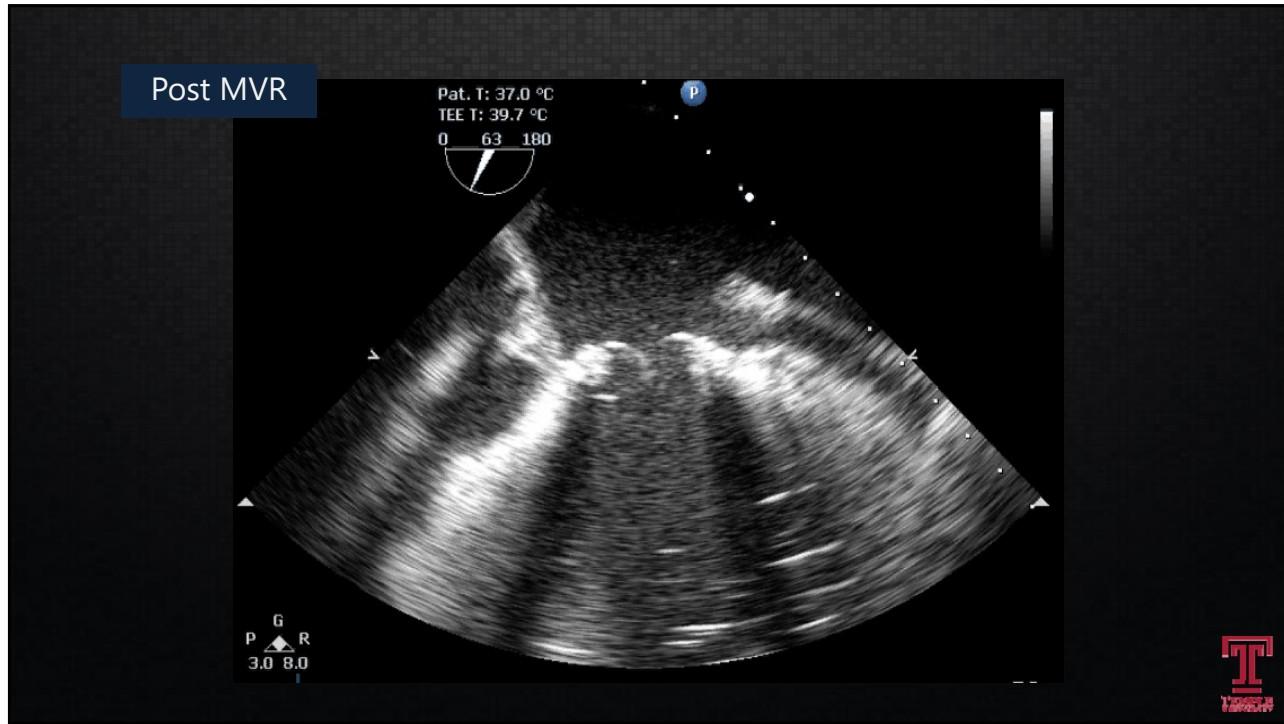
- ✓ 68 yo male
 - Bioprosthetic MVR for IE (4 months ago)
 - Severe LV dysfunction, LVEF 10-15%
 - CKD on HD, T2DM, Prior CVA



Fevers, chills, SOB, rigors; Staph epi multiple culture bottles







Prosthetic Valve Endocarditis

Piper et al. BMJ 2001

Table 1 Microbiology of early and late PVE. Authors' own findings compared to a recent European literature review³

	<i>Early PVE (%)</i>		<i>Late PVE (%)</i>	
	<i>Own experience (n=34)</i>	<i>Europe (n=68)</i>	<i>Own experience (n=132)</i>	<i>Europe (n=194)</i>
<i>Staphylococcus epidermidis</i>	29	43	21	28
<i>Staphylococcus aureus</i>	18	13	19	13
Streptococci	6	3	15*	20
Enterococci	6	2	18	7.5
HACEK	18	17	8	7
Fungi	9	6	5	4
Mixed infections	6	—	3	—
Others	6	12	7	9
Culture negative	3	4	4	12

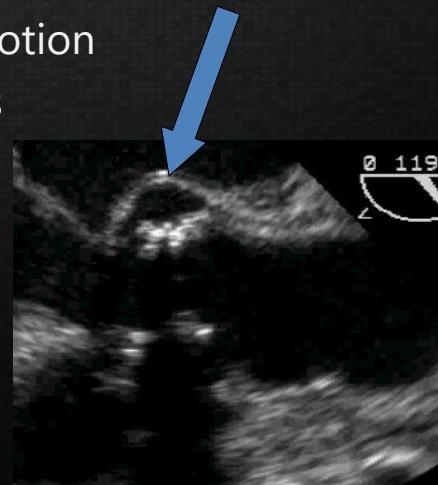
*Viridans group n=13 (10%), β haemolytic streptococci n=3 (2%), and *Streptococcus bovis* n=4 (3%).

HACEK, *Haemophilus*, *Actinobacillus*, *Cardiobacterium*, *Eikenella*, *Kingella*.



Prosthetic Valve Endocarditis

- ✓ Perivalvular regurgitation
- ✓ Dehiscence/rocking motion
- ✓ Bulging of the annulus
- ✓ Necessitates TEE



ASCeXAM Focus

- ✓ Review
 - Guidelines for prophylaxis
 - Diagnosis and indications for TEE
 - Identification of complications
 - Prognostic (echocardiographic) features
 - Indications for surgery



ASCeXAM Focus

- ✓ Appropriate indications for TEE in IE
- ✓ Echocardiographic features of vegetations as described in modified Duke criteria
- ✓ Complications of IE and terminology
- ✓ Follow-up study if high suspicion and initial study negative





Thank You!